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First Quarterly Progress Report

for

"A Cloud Physics Investigation
Utilizing Skylab Data"

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The overall Cloud Physics Investigation has been subdivided into six areas for convenience of reporting and providing a suitable format for the Milestone Plan.

Task I - Transmittances

The goal here is to be able to calculate the two way transmittance of the atmospheres for a given sun-satellite geometry and a specified cloud top pressure level. In the oxygen "A" band a program that computes transmittance using a layered atmosphere and line parameters as reported by Burch and Gryvnak is being prepared. Preliminary calculations about the distance into the wings of the line it is necessary to go have been performed and further calculations have shown that a simple approximation to the partition function is possible.

The $2.0 \mu\text{m CO}_2$ band is a much more complicated situation. There are well over 500 lines in the spectral interval of interest. Utilizing data recently compiled by Calfie and McClatchey, it is planned that initially band model calculations will be attempted. If these do not give sufficient accuracy then line-by-line calculations are required. During the next reporting period, we anticipate completion of the "A" band program. The personnel involved in this task are Alishouse, Van Cleef (programmer), and Wark.

Task II - Scattering Calculations

We are computing single particle scattering functions for the frequencies (wavelength) of interest to our investigation for both liquid water and ice particles of appropriate dimensions. These single particle scattering functions will then be convoluted with various particle size distributions to give phase functions for clouds of different optical thickness. The programs involved in these computations have been checked out and it is anticipated that this task will be completed in the next reporting period. These calculations are being performed by Dr. Jacobowitz.

Task III - Cloud Models and Calculation of Returned Signal

For all clouds it has been assumed that the particle size distribution is Gaussian. This requires specifying a mean radius and a standard deviation. For the liquid water clouds particle sizes of 1 to 20 μ m being absolute cut-offs and all increments were in 1 μ m intervals. The mean radii were 4, 8, 12, and 16 μ m with standard deviations of 0.5, 1.0, and 2.0 μ m. The ice clouds are represented as equivalent spheres with radii ranging from 10-100 μ m in increments of 10 μ m. Mean radii of 30, 50, and 70 μ m were assumed as were standard deviations of 5, 10, and 15 μ m.

It is anticipated that this work by Dr. Jacobowitz will be completed during the next reporting period.

Finally, the results from Tasks I, II, and IIIa will be combined to compute the signals received by the S191 radiometer. The personnel involved in this will be Jacobowitz and Alishouse.

Task IV - Deconvolution Procedure

Presently the S191 has less spectral resolution in the "A" band than is deemed optimum for this experiment, however the S191 will have a very high signal-to-noise ratio for clouds. The deconvolution procedure, in effect, trades signal-to-noise for spectral resolution. It is anticipated that Mr. Henry Fleming will complete this project during the next reporting period, although this is contingent upon Mr. Fleming's availability and the receipt of instrument calibration data.

Task V - Cloud Truth Data

We have been advised that support missions by NASA aircraft were flown on June 4 and June 13, although no data have been received. In addition relevant pilot reports were obtained from the National Weather Service for June 4, June 5, and June 12. During this reporting period, we anticipate a more active role

in obtaining pilot reports in support of Skylab 3. Personnel involved in this effort will be M. Marini (technician) and Alishouse.

Task VI - Analysis and Reduction of Satellite Data

Very little progress has been made on this task because we have received neither satellite data instrument calibration data, nor a sample data tape. We anticipate the receipt of such data during this quarter and a major effort will be mounted on this task. The services of a second programmer (M. Hill) have been obtained so that the personnel involved in this task will be M. Hill, M. Marini, the P. I., and the Co-I's.

Milestone Plan.

Attached to this report is a milestone plan for the Cloud Physics investigation broken down into six tasks. The X's indicate the months during which the major part of the work involved in that task will be done.

Travel

No travel was performed for this investigation during this reporting period.

MILESTONE PLAN FOR CLOUD PHYSICS INVESTIGATION

MONTHS

FY 73

FY 74

CY 73

CY 74

Task

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I. Transmittances	X X X X	X X X X X	
II. Scattering Calculations	X	X X	
III. Cloud Models, Etc.	X	X X X X	
IV. Deconvolution		X	
V. Cloud Truth	X	X X X X X X	X X
VI. Satellite Data		X X X X X X	X X X X X X